CLAIMS

1. A virtual library of possible combinatorially derived product molecules which can be searched for product molecules having desired properties without the necessity of generating the product structures during the search, generated by the following process:

a. Creating one or more files identifying one or more combinatorial reactions for one or more core structures;

b. Creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

c. Associating with each structural variation, data, characterizing each structural variation including:

(1) Characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(2) Characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations.

2. A virtual library of possible combinatorially derived product molecules which can be searched for product molecules having desired properties without the necessity of generating the product structures during the search, generated by the following process:

a. creating one or more files identifying one or more combinatorial reactions for one or more core structures:

b. creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction:

c. associating with each structural variation, data, characterizing each structural variation including:

(1). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses. which has not been derived from the application of validated molecular structural descriptors: and

(2). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses. which has been derived from applying validated molecular structural descriptors to the structural variations: and

d. associating with each core, data characterizing each core including:

(1). characterizing data which has not been derived from application of validated molecular descriptors: and

(2) characterizing data which is derived by the following additional steps:

(a) selecting a first core:

(b). selecting an attachment bond on the core:

(c) topomerically aligning the core:

(d) characterizing the core with CoMFA fields and the coordinates of the end points of the other attachment bonds:

(e) repeating steps (b) through (d) for all attachment bonds on the core:

(f) selecting a next core: and

(g) repeating steps (b) through (1') for all cores.

3. A virtual library of possible combinatorially derived product molecules which can be searched for product molecules having desired properties without the necessity of generating the product structures during the search, generated by the following process:

a. defining chemical transformations and reagents and cores to be used to generate product molecules: and

b. using appropriate molecular descriptors to precalculate characteristics of the component parts of all possible product molecules.

4. A screening library designed by a computer-based method which selects the screening library molecules from those molecules which could be created by all combinatorial arrangements of specified structural variations and a common core molecule comprising the following steps:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. identifying in the virtual library all possible combinatorial product molecules which could result from the specified reactants and selected core molecules;

c. selecting from all possible combinatorial product molecules a product molecule for inclusion in the subset;

d. using a validated molecular descriptor appropriate to whole molecules with which the Virtual Library was generated, removing from the set of all remaining molecules those molecules falling within a chosen neighborhood distance of the selected molecule;

e. using a validated molecular descriptor appropriate to the structural variations with which the Virtual Library was generated, removing from the set of all remaining product molecules those molecules formed from structural variations falling within a chosen neighborhood distance of the structural variations of the selected molecule;

f. selecting from the set of all product molecules remaining after step **e** a product molecule for inclusion in the subset;

g. repeating steps **d** through **f** until no additional product molecules remain to be selected in step **f**; and

h. Outputting a list of the selected subset and/or the structural variations from which the subset can be formed.

5. A screening library designed by a computer-based method which selects the screening library molecules from those molecules which could be created by all combinatorial arrangements of specified structural variations and core molecules comprising the following steps:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one

or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. selecting from all possible cores a core upon which to base the subset;

c. using a validated molecular descriptor appropriate to cores, selecting from the set of all possible cores those core molecules falling within the neighborhood distance of the selected core molecule;

d. identifying all possible combinatorial product molecules which could result from the specified reactants and selected core molecules;

e. selecting from all possible combinatorial product molecules a product molecule for inclusion in the subset;

f. using a validated molecular descriptor appropriate to whole molecules with which the Virtual Library was generated, removing from the set of all remaining molecules those molecules falling within a chosen neighborhood distance of the selected molecule;

g. using a validated molecular descriptor appropriate to the structural variations with which the Virtual Library was generated, removing from the set of all remaining product molecules those molecules formed from structural variations falling within a chosen neighborhood distance of the structural variations of the selected molecule;

h. selecting from the set of all product molecules remaining after step **g** a product molecule for inclusion in the subset;

i. repeating steps **f** through **h** until no additional product molecules remain to be selected in step **h**; and

j. Outputting a list of the selected subset and/or the structural variations and cores from which the subset can be formed.

6. The use of a subset of molecules, which could be made in a combinatorial synthesis of specified reactants and common core, to specify the compounds to be synthesized and tested in appropriate assays, said subset being selected by the following computer-based method:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. identifying in the virtual library all possible combinatorial product molecules which could result from the specified reactants and selected core molecules;

c. selecting from all possible combinatorial product molecules a product molecule for inclusion in the subset;

d. using a validated molecular descriptor appropriate to whole molecules with which the Virtual Library was generated, removing from the set of all remaining molecules those molecules falling within a chosen neighborhood distance of the selected molecule;

e. using a validated molecular descriptor appropriate to the structural variations with which the Virtual Library was generated, removing from the set of all remaining product molecules those molecules formed from structural variations falling within a chosen neighborhood distance of the structural variations of the selected molecule;

f. selecting from the set of all product molecules remaining after step e a product molecule

for inclusion in the subset;

g. repeating steps **d** through **f** until no additional product molecules remain to be selected in step **f**; and

h. Outputting a list of the selected subset and/or the reactants from which the subset can be formed.

7. The use of a subset of molecules, which are most likely to have the same type of activity as a molecule of interest and selected from those which could be made in a combinatorial synthesis from specified reactants and a common core molecule, to specify the compounds to be synthesized and tested in appropriate assays, said subset being selected by the following computer-based method:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. identifying in the virtual library all possible combinatorial product molecules which could result from the specified reactants and selected core molecules;

c. selecting from all possible combinatorial product molecules a product molecule for inclusion in the subset;

d. characterizing the molecule of interest with both a validated molecular structural descriptor appropriate to whole molecules with which the virtual library was generated and with a validated molecular structural descriptor appropriate to structural variations

with which the virtual library was generated;

e. using the same validated molecular descriptor appropriate to whole molecules, selecting the set of all possible molecules whose descriptor values fall within a chosen neighborhood distance of the selected molecule, and using the same validated molecular descriptor appropriate to structural variations, selecting the set of all possible molecules whose descriptor values fall within a chosen neighborhood distance of the selected molecule; and

f. Ouputting a list of the selected subset and/or the reactants from which the subset can be formed.

8. The use of a subset of molecules, which are most likely to have the same type of activity as a molecule of interest and selected from those which could be made in a combinatorial synthesis from specified reactants and a common core molecule, to specify the compounds to be synthesized and tested in appropriate assays, said subset being selected by the following computer-based method:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures;

(2). creating separate structural variation files (associated with the reaction identifying files) in which are iisted together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction;

(3). associating with each structural variation, data, characterizing each structural variation including:

(a). characterization data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has not been derived from the application of validated molecular structural descriptors; and

(b). characterizing data, taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses, which has been derived from applying validated molecular structural descriptors to the structural variations;

b. identifying in the virtual library all possible combinatorial product molecules which could result from the specified reactants and selected core molecules;

c. selecting from all possible combinatorial product molecules a product molecule for

inclusion in the subset;

d. characterizing the molecule of interest with a combination validated molecular descriptor, characterizing both whole molecule and structural variation features, with which the Virtual Library was generated;

e. using the same validated molecular descriptor, selecting the set of all possible molecules whose descriptor values fall within a chosen neighborhood distance of the selected molecule; and

f. Ouputting a list of the selected subset and/or the reactant from which the subset of molecules can be formed.

9. The use of a subset of molecules, which could be made in a combinatorial synthesis of specified reactants and core molecules. to specify the compounds to be synthesized and tested in appropriate assays. said subset being selected by the following computer-based method:

a. generating a virtual library by:

(1). creating one or more files identifying one or more combinatorial reactions for one or more core structures:

(2). creating separate structural variation files (associated with the reaction identifying files) in which are listed together the structural variations representative of those reactants which will react at each variation site of each combinatorial reaction:

(3). associating with each structural variation. data. characterizing each structural variation including:

(a). characterizing data. taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses. which has not been derived from the application of validated molecular structural descriptors: and

(b) characterizing data. taking into account when necessary the structures of the cores with which the structural variations would be combined in the listed combinatorial syntheses. which has been derived from applying validated molecular structural descriptors to the structural variations:

b. selecting from all possible cores a core upon which to base the subset:

c. using a validated molecular descriptor appropriate to cores. selecting from the set of all possible cores those core molecules falling within a chosen neighborhood distance of the selected core molecule:

d. identifying all possible combinatorial product molecules which could result from the specified structural variations and selected core molecules:

e. selecting from all possible combinatorial product molecules a product molecule for inclusion in the subset:

f. using a validated molecular descriptor appropriate to whole molecules with which the virtual library was generated, removing from the set of all remaining molecules those molecules falling within a chosen neighborhood distance of the selected molecule:

g. using a validated molecular descriptor appropriate to the structural variations with which the virtual library was generated. removing from the set of all remaining product molecules those molecules formed from structural variations falling within a chosen neighborhood distance of the structural variations of the selected molecule:

h. selecting from the set of all product molecules remaining after step if a product molecule for inclusion in the subset:

i. repeating steps f through h until no additional product molecules remain to be selected in step b: and

j. outputting a list of the selected subset and/or the structural variations and cores from which the subset can be formed.